CATALOGUE

—OF—

MELLERT

Foundry and Machine Co.

(LIMITED),

READING, PA.,

1891.

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MELLERT FOUNDRY AND MACHINE COMPANY

(LIMITED),

MANUFACTURERS OF

CAST-IRON PIPE FOR WATER AND GAS

Sewers, Culverts and Drains,

EITHER BELL AND SPIGOT OR FLANGE, WITH CONNECTIONS OR SPECIAL CASTINGS,

FIRE HYDRANTS, STOP VALVES, LAMP POSTS,

CANADA TURBINES, &c., &c.

General Foundry and Machine Work.

READING, PA.,

1891.

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History and Growth of the Plant.

The works of the Mellert Foundry and Machine Company, Limited, were established by John Mellert & Sons in the spring of 1848, at Second and Chestnut Streets, Reading, Pa. In 1851 they commenced the manufacture of cast-iron pipe, casting them horizontally in lengths of nine feet, thus making them pioneers in this line of trade.

The plant has developed from a small beginning into an extensive and well-known business establishment.

In this connection we would add that the Reading Foundry Company, Limited, was organized in the fall of 1884, and had completed and in operation by July 1, 1887, with other buildings, a large and well-equipped pipe foundry, located at Kissinger Station, Reading, Pa.

The business of these two companies is carried on separately, though under the same management.

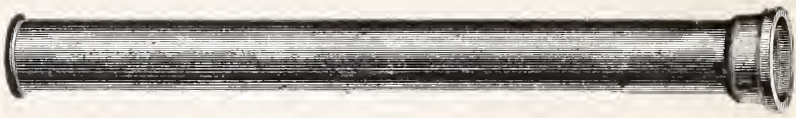
Board of Managers of Mellert Foundry and Machine Company, Limited:

P. D. WANNER, Chairman, Reading, Pa.
A. H. MELLERT, Manager of Works, Reading, Pa.
R. B. KINSEY, Secretary, " "
F. A. KNOPP, Treasurer, " "
WILLIAM J. ROURKE,. " "

Board of Managers of the Reading Foundry Company, Limited:

P. D. WANNER, Chairman, Reading, Pa.
A. H. MELLERT, Manager of Works, Reading, Pa.
R. B. KINSEY, Secretary, " "
F. A. KNOPP, Treasurer, " "
JOHN FOX, New York.

Cast-Iron Pipe.



Bell and Spigot for Water, Gas, &c.

We cast these pipe vertically in dry sand moulds, in twelve feet lengths, exclusive of bells, from three to forty-eight inches in diameter and of the thickness of metal, and weight per foot or length, including bells, for such use or pressure as may be required, as set forth in tabular forms on pages 8 and 9.

Three and four inch pipe we cast with bells up; six, eight, ten, and twelve inch with bells up or down as may be preferred: all above twelve inch with bells down.

On this subject of casting pipe with bells up or down we referred to at length in a former catalogue. We would now simply add that either way has its advantages and disadvantages, and that we are prepared to leave the choice, so far as it applies to six, eight, ten, and twelve inch, to the purchaser.

Water and Gas Pipe.

These pipe, on coming from the Foundry, are thoroughly cleaned and examined, after which those intended for water are heated and given the usual bath of prepared coal tar and tested under hydraulic pressure, with hammer, at three hundred pounds to the square inch.

Pipe intended for gas are not coated, usually of a lighter weight, and tested at two hundred pounds.

In the absence of instructions we make the pipe, whether for gas

or for water, of standard, or what we call medium weights, as shown in the following table with other information, viz.:

Standard Weight of Pipe for Gas and Water per Foot and per Length, including Bells.

Diameter.	For Gas.		For Water		Length of Pipe over All.	Depth of Bell or Socket.	Joint Room or Lead Space.	Depth of Lead in Socket.	Weight of Lead to Socket.	
	lbs. per ft.	lbs. per length.	lbs. per ft.	lbs. per length.						
in.					ft. in.	in.	in.	in.	lbs.	
3	11	132	12	144	12—4	$3\frac{1}{2}$	$\frac{5}{16}$	$1\frac{7}{8}$	$3\frac{1}{2}$	The average weight of Bells of pipe equals about the weight of one foot of the weight of each respective pipe.
4	18	216	20	240	12—4	$3\frac{1}{2}$	$\frac{5}{16}$	$1\frac{7}{8}$	5	
6	$28\frac{1}{2}$	342	$31\frac{1}{2}$	378	12—4	4	$\frac{5}{16}$	2	8	
8	40	480	45	540	12—4	4	$\frac{5}{16}$	2	10	
10	55	660	60	720	12—4	4	$\frac{5}{16}$	2	12	
12	70	840	80	960	12—4	4	$\frac{5}{16}$	2	15	
14	90	1080	100	1200	12—4	4	$\frac{5}{16}$	2	18	
16	110	1320	125	1500	12—4	4	$\frac{3}{8}$	$2\frac{1}{4}$	22	
18	140	1680	150	1800	12—4	4	$\frac{3}{8}$	$2\frac{1}{4}$	25	
20	150	1800	170	2040	12—4	4	$\frac{3}{8}$	$2\frac{1}{4}$	28	
24	200	2400	225	2700	12—4	4	$\frac{3}{8}$	$2\frac{3}{8}$	38	
30	290	3480	340	4080	12—4	4	$\frac{7}{16}$	$2\frac{3}{8}$	55	
36	360	4320	420	5040	12—4	4	$\frac{1}{2}$	$2\frac{1}{2}$	70	
40	420	5040	500	6000	12—4	5	$\frac{1}{2}$	$2\frac{1}{2}$	80	
48	560	6720	670	8040	12—4	5	$\frac{1}{2}$	$2\frac{5}{8}$	100	

5 per cent. claimed for variation from 3 to 24 inch, and 3 per cent. from 24 to 48 inch.

The weights of pipe given in the preceding table per length are as light as we would recommend, to secure good and effective service.

We know it to be a great mistake, and no economy, to bury light pipe, either for gas or for water. Engineers may be all right theoretically as to thickness of metal required under certain pressure, but practically, we think, they should more frequently recommend heavier pipe than they do.

The following table, styled "American Association Standard," was recommended to and accepted by the American Water Works Association at Chicago, May 20, 1890. This table strikes us very favorably and is in accordance with our views on the subject pertaining to weights, &c., of pipe.

American Association Standard,

Proposed for Cast-Iron Water Pipe.

Size, Inches Diameter.	Class.	Outside Diameter, inches.	Average Thickness of Barrel, inches.	Weight per 1000 feet in pounds.	Weight per Length, (12 ft. 4 in.) including Bell.		
					Average.	Max.	Min.
3	A	.....	.....	14,000	168	178	160
	B	3.856	.428	15,580	187	196	178
	C	.....	.....	17,170	206	216	196
4	A	.....	.....	19,170	230	243	218
	B	4.904	.452	21,330	256	267	243
	C	.....	.....	23,500	282	296	267
6	A	.....	.....	31,330	376	397	357
	B	7.000	.500	34,830	418	439	397
	C	.....	.....	38,330	460	483	439
8	A	.....	.....	44,750	537	567	510
	B	9.094	.547	49,750	597	627	567
	C	.....	.....	54,750	657	690	627
10	A	.....	.....	60,570	727	768	691
	B	11.190	.595	67,330	808	848	768
	C	.....	.....	74,080	889	933	848
12	A	.....	.....	78,250	939	991	892
	B	13.286	.643	86,920	1,043	1,095	991
	C	.....	.....	95,580	1,147	1,204	1,095
16	A	.....	.....	119,170	1,430	1,510	1,359
	B	17.476	.738	132,420	1,589	1,668	1,510
	C	.....	.....	145,580	1,747	1,834	1,668
20	A	.....	.....	165,330	1,984	2,195	1,885
	B	21.666	.833	183,750	2,205	2,315	2,195
	C	.....	.....	202,080	2,425	2,546	2,315
24	A	.....	.....	220,750	2,649	2,796	2,517
	B	25 856	.928	245,250	2,943	3,090	2,796
	C	.....	.....	269,750	3,237	3,398	3,090
30	A	.....	.....	316,250	3,795	4,006	3,605
	B	32.142	1.071	351,420	4,217	4,428	4,006
	C	.....	.....	386,580	4,639	4,871	4,428
36	A	.....	.....	428,750	5,145	5,431	4,888
	B	38.428	1.214	476,420	5,717	6,003	5,431
	C	.....	.....	524,080	6,289	6,603	6,003
48	A	.....	.....	710,670	8,528	9,002	8,102
	B	51.000	1.500	789,670	9,476	9,950	9,002
	C	.....	.....	868,670	10,424	10,945	9,950

Culvert or Drain Pipe.

Cast-iron pipe for culvert or drain purposes came into use only within the last few years, but have already attained to a trade of very large proportions all over the country, supported by railroad companies, turnpike companies, and street commissioners. They are vastly superior to stone or brick culverts, terra-cotta pipe, or wooden trunks.

We would further recommend their use to supervisors of country roads where they now have stone culverts or wooden bridges, where pipe would make a better job and prove cheaper after the first cost.

Formerly we broke up and remelted all damaged or defective pipe intended for gas or water, where we now generally sell them faster than we get them for the uses above referred to.

Sewer Pipe.

We have for some years advocated the superiority of cast-iron pipe for sewer purposes for cities over brick and stone or terra-cotta. The first cost of cast-iron pipe might be somewhat higher, but they would more than make up the difference by the absence of repairs incident to rain storms by which the ordinary sewers are constantly endangered and damaged.

The heavy rains in 1889 in Philadelphia cost that city $55,000 for repairs, where, if their sewers had been of cast-iron, there would have been no expense from that source whatever.

A prominent engineer remarked to us recently: "I see no good reason against the use of cast-iron pipe for sewer purposes, and believe their adoption will be almost universal before many years. Their general use has been retarded only by the difference in cost and the belief that sewerage would rust the iron; but with cheap iron and the numerous coating processes to prevent rusting, their general adoption must follow."

Cast-iron sewer pipe could be made of almost any size if made in sections, though we believe that few sewers would require larger pipe than 48 inches in diameter.

Pipe sewers can be flushed more readily than brick or stone, and with the present improved drilling machinery could be easily tapped at any point, and complete connections effected by the use of hat flanges.

Thickness and Weight of Cast-Iron Pipe per Foot, exclusive of Bells.

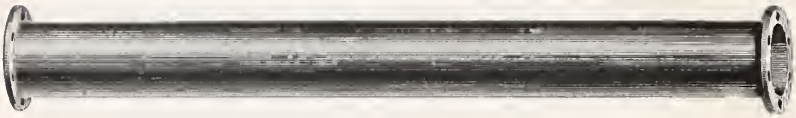
Inches Diameter.	THICKNESS OF METAL.																
	$\frac{5}{16}$ in.	$\frac{3}{8}$ in.	$\frac{7}{16}$ in.	$\frac{1}{2}$ in.	$\frac{9}{16}$ in.	$\frac{5}{8}$ in.	$\frac{11}{16}$ in.	$\frac{3}{4}$ in	$\frac{13}{16}$ in.	$\frac{7}{8}$ in.	$\frac{15}{16}$ in.	1 in.	$1\frac{1}{16}$ in.	$1\frac{1}{8}$ in.	$1\frac{3}{16}$ in.	$1\frac{1}{4}$ in.	$1\frac{5}{16}$ in.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
3	10.26	12.55	14.91	17.35	19.87	22.46	25.14	27.89	30.71	33.62							
4		16.27	19.25	22.31	25.45	28.66	31.95	35.30	38.77	42 29							
6			27.91	32.22	36.60	41.05	45.59	50.19	54.88	59.64	64.49	69.40					
8			36.60	42.14	47.75	53.45	59.22	65.07	70.99	77.00	83.08	89.23					
10				52.05	58.91	65.84	72.85	79.94	87.10	94.35	101.67	109.07	116.54	124.09			
12					70.06	78.23	86.48	94.81	103.21	111.70	120.25	128.89	137.61	146.40			
14					81.22	90.63	100.12	109.68	119.33	129.05	138.85	148.72	158.68	168.71	178.81		
16						103.02	113.75	124.55	135.44	146.40	157.44	168.56	179.75	191.02	202.37		
18							127.38	139.43	151.55	163.75	176.03	188.38	200.81	213.32	225.91	238.57	251.32
20							141.02	154.30	167.66	181.10	194.62	208.21	221.89	235.63	249.46	263.37	277.34
24								184.05	199 89	215.80	231.80	247.87	264.02	280.25	296.56	312.94	329.40
30								228.66	248.22	267.86	287.57	307.36	327.23	347.18	367.20	387 30	407.48
36								273.28	296.56	319.91	343.34	366.85	390.44	414.10	437.84	461.66	485.56
40										354.61	380.52	406.52	432.56	458.72	484.95	511.24	537.62
48												485.83	516.86	547.94	579.13	610.40	641.71

Thickness of Metal Recommended for Heads of Water from 50 Feet to 500 Feet, and Weight of Pipe per Length, including Bells.

Diameter.	50 ft. Head.		100 ft. Head.		150 ft. Head.		200 ft. Head		250 ft. Head.		300 ft. Head.		350 ft. Head.		400 ft. Head.		450 ft. Head.		500 ft. Head.	
	Thickness of Metal.	Weight per Length.	Thickness of Metal.	Weight per Length.	Thickness of Metal.	Weight per Length.	Thickness of Metal.	Weight per Length.	Thickness of Metal.	Weight per Length	Thickness of Metal.	Weight per Length.	Thickness of Metal.	Weight per Length.	Thickness of Metal.	Weight per Length.	Thickness of Metal.	Weight per Length.	Thickness of Metal.	Weight per Length.
In.	in.	lbs.	in	lbs.	in	lbs.	in.	lbs.	in.	lbs.	in	lbs.	in.	lbs.	in.	lbs.	in.	lbs.	in.	lbs.
3	.3352	142	.3412	145	.3472	148	.3532	151	.3592	156	.3652	159	.3712	163	.3772	166	.3832	170	.3892	173
4	.3820	213	.3900	218	.3975	223	.4040	228	.4120	236	.4200	242	.4280	248	.4360	254	.4440	260	.4520	267
6	.4189	342	.4309	352	.4429	364	.4549	375	.4699	390	.4789	400	.4909	411	.5029	425	.5149	437	.5269	450
8	.4648	500	.4808	519	.4968	538	.5128	555	.5288	582	.5448	600	.5608	620	.5768	640	.5928	660	.6088	680
10	.5062	676	.5262	703	.5462	739	.5662	760	.5862	799	.6062	828	.6262	856	.6462	886	.6662	916	.6862	946
12	.5444	869	.5684	908	.5924	949	.6164	1002	.6404	1042	.6644	1073	.6884	1123	.7124	1165	.7364	1206	.7604	1248
14	.5801	1119	.6081	1175	.6361	1232	.6641	1289	.6921	1346	.7201	1403	.7481	1460	.7761	1515	.8041	1570	.8321	1625
16	.6140	1350	.6450	1423	.6780	1496	.7100	1569	.7420	1642	.7740	1715	.8060	1788	.8380	1861	.8700	1934	.9020	2007
18	.6462	1596	.6822	1688	.7182	1781	.7542	1874	.7902	1966	.8262	2060	.8622	2153	.8982	2247	.9342	2341	.9702	2435
20	.6772	1949	.7172	2067	.7572	2186	.7972	2307	.8372	2428	.8772	2548	.9172	2669	.9572	2790	.9972	2910	1.0372	3030
24	.7358	2408	.7838	2572	.8318	2735	.8798	2899	.9278	3063	.9758	3227	1.0238	3441	1.0718	3602	1.1198	3763	1.1678	3924
30	.8177	3506	.8777	3771	.9377	4036	.9977	4303	1.0577	4573	1.1177	4840	1.1777	5110	1.2377	5375	1.2977	5640	1.3577	5905
36	.8940	4369	.9660	4732	1.0380	5096	1.110	5459	1.182	5823	1.254	6186	1.3260	6550	1.3980	6915	1.4700	7280	1.5420	7645
40	.9424	5111	1.0224	5559	1.1024	6006	1.1824	6454	1.2624	6901	1.3424	7349	1.4224	7794	1.5024	8241	1.5824	8688	1.6624	9135
48	1.0348	6722	1.1308	7364	1.2268	8006	1.3228	8649	1.4188	9291	1.5148	9932	1.6108	10575	1.7068	11217	1.8028	11859	1.8988	12501

Note.—Pressure of water per square inch is 21.65 lbs. for every 50 feet head.

Flange Pipe.



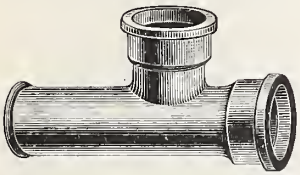
We make these pipe in the same way we do the bell and spigot, and have adopted the following table, viz.:

Standard Flange Pipe, Medium Weights.

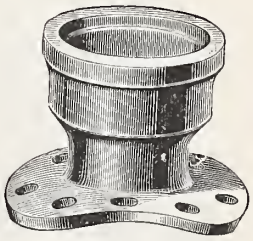
				FLANGES.					
Diameter of Pipe.	Length of Pipe.	Thickness of Metal.	Medium Weight per Length, including Flanges.	Diameter.	Thickness.	Weight of Each.	Diameter from Centre to Centre of Holes.	Number of Bolts.	Size of Bolts.
in.	ft.	in.	lbs.	in.	in.	lbs.	in.	in.	in.
3	12	$\frac{3}{8}$	160	$8\frac{1}{2}$	$\frac{7}{8}$	10.52	$6\frac{3}{4}$	4	$\frac{5}{8}$
4	12	$\frac{7}{16}$	240	9	1	11.82	$7\frac{1}{4}$	4	$\frac{5}{8}$
6	12	$\frac{15}{32}$	378	12	$1\frac{1}{16}$	21.03	$10\frac{1}{8}$	6	$\frac{5}{8}$
8	12	$\frac{1}{2}$	540	14	$1\frac{1}{8}$	26.72	$12\frac{1}{8}$	6	$\frac{3}{4}$
10	12	$\frac{9}{16}$	760	16	$1\frac{1}{8}$	30.73	14	8	$\frac{3}{4}$
12	12	$\frac{5}{8}$	1000	18	$1\frac{1}{4}$	38.33	16	8	$\frac{3}{4}$
14	12	$\frac{5}{8}$	1200	20	$1\frac{1}{4}$	43.23	$18\frac{1}{4}$	10	$\frac{3}{4}$
16	12	$\frac{11}{16}$	1500	23	$1\frac{3}{8}$	64.51	$20\frac{11}{16}$	10	$\frac{3}{4}$
18	12	$\frac{3}{4}$	1800	25	$1\frac{1}{2}$	75.83	$22\frac{1}{2}$	12	$\frac{7}{8}$
20	12	$\frac{3}{4}$	2050	28	$1\frac{5}{8}$	108.00	$25\frac{1}{2}$	12	$\frac{7}{8}$
24	12	$\frac{7}{8}$	2700	32	$1\frac{3}{4}$	130.47	$29\frac{1}{2}$	14	$\frac{7}{8}$
30	12	1	4000	40	$1\frac{7}{8}$	223.08	$36\frac{7}{8}$	20	1
36	12	$1\frac{1}{32}$	5000	46	2	275.62	$42\frac{3}{8}$	24	1
40	12	$1\frac{1}{8}$	6000	50	$2\frac{1}{8}$	313.81	$46\frac{1}{2}$	26	1
48	12	$1\frac{1}{4}$	8000	58	$2\frac{1}{4}$	378.20	$54\frac{3}{4}$	30	$1\frac{1}{8}$

Connections or Special Castings,

For Bell and Spigot or Flange Pipe, such as Branches, Bends, Curves, Reducers, Sleeves, Plugs, Caps, &c., &c.



Three Way.



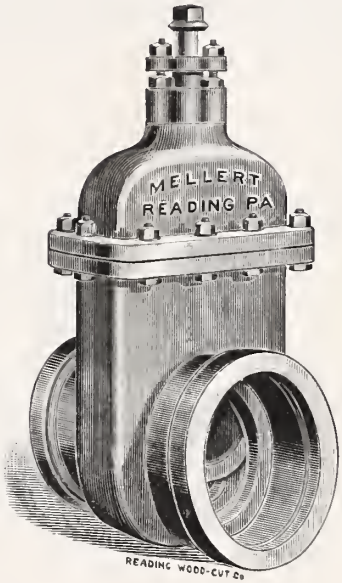
Hat Flange.

Of these castings we usually carry a large assortment in stock, and are prepared to make them of almost every conceivable shape and form to suit the peculiarity of the connections to be made ; all that we ask of purchasers is an idea or sketch of what they require, and we can usually help them out without delay.

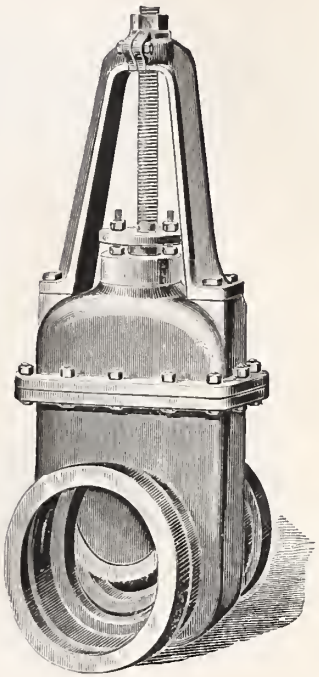
We also manufacture flexible pipe-joints.

Water Gates or Stop Valves.

Bell Ends Inside Screw.



Bell Ends Outside Screw.



Size.	Weight.	Price.	Size.	Weight.	Price.
2 in.....	50 lbs.	$6 00	**16** in.....	1300 lbs.	$85 00
3 ".....	70 "	8 00	**18** ".....	1500 "	110 00
4 ".....	110 "	11 00	**20** ".....	1650 "	130 00
6 ".....	210 "	15 00	**24** ".....	2300 "	190 00
8 ".....	350 "	22 00	**30** ".....	3100 "	350 00
10 ".....	510 "	32 00	**36** ".....	4100 "	660 00
12 ".....	660 "	42 00	**40** ".....		.....
14 ".....	800 "	75 00	**48** ".....		.....

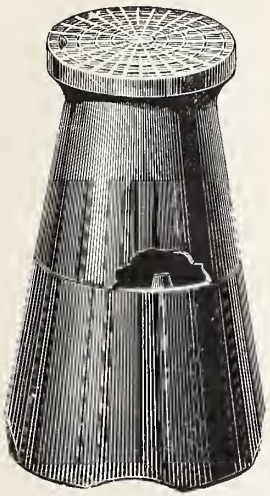
Discount *per cent.*

Special price for valves with outside screws or flanged ends.

These valves have brass seats and fittings, square threads on the opening screws, with all parts interchangeable, and furnished to open either to the right or left, according to the desire of the purchaser. We guarantee these valves to be equal in finish and service to any others in the market. It is the old solid wedge-valve, properly and carefully constructed.

We manufacture also check valves of above sizes.

Street and Service Stop Boxes.



No. 1.

No. 2.

Of these boxes we make quite a variety. Every stop valve should be properly secured by a casing of some kind. We believe that cast-iron boxes or casings, such as we make, are of the best and cheapest offered to the trade.

Cut No. 1 represents one of our street stop boxes, and Cut No. 2 an extension service stop box, lately introduced by us to the trade. It is cheap and exceedingly well adapted to its purpose.

We do not believe in the cheap extension boxes for street stops now so extensively offered to the trade. They are too cheap to be of good service.

Fire Hydrants,

Old Style.

No. **1**, with one 2½-inch nozzle.....$25 00

2, " two 2½ " " 27 00

3, " either one or two 2½-inch nozzles, and one 4½-inch nozzle for steamer connection. 35 00

Discount *per cent.*

All furnished with frost casings.

Nos. 1 and 2 require a 4-inch pipe connection and No. 3 a 6-inch.

The valves of these hydrants are pear-shaped, made of leather, and have brass valve seats and fittings, square threads on the opening screws, and furnished to open either to the right or left, as desired.

Having manufactured hydrants for many years, we thought we had a hydrant equal to the best in the market ; but it did not combine the qualities required in late years—that is, efficiency with the ability to get at the valve or seat for repairs without digging up the stand-pipe. To overcome this effectively was the point to be attained.

After examining and comparing all the principal hydrants manufactured, with our own, we made such improvements as we thought would make it generally acceptable, and had a patent issued for those improvements May 1, 1888, which, however, did not fully satisfy us, and we kept on improving until we had what we now present — the "Mellert"— (see next page), which was patented June 10, 1890.

All the working parts of this hydrant can be operated with an ordinary twelve-inch monkey-wrench, and the valve and seat lifted out of the stand-pipe with perfect ease within a few minutes.

It is designed to give ample area and free flow of water, giving a larger percentage of pressure and volume of water at the nozzles than any other hydrant in the trade. The drip is positive, and operated by the main valve-stem at the top of the stand-pipe, and drains the stand-pipe completely.

All its parts are interchangeable.

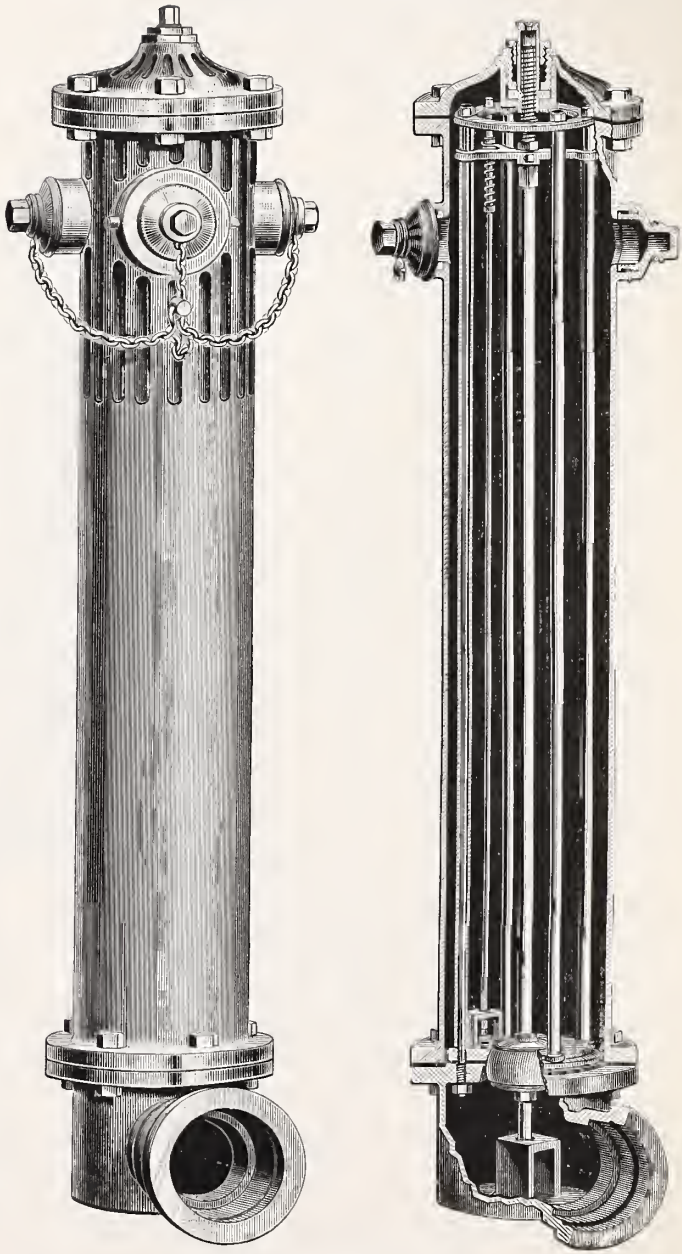
The threads being at the top of the stand-pipe, can be readily inspected and kept in oil, and an examination of the valve made without shutting off the water in the main.

The cross-bar and thread of the valve-stem being above, prevent all torsional strain upon it, making the valve close firmly, and enabling it to be freely opened against the heaviest pressure.

The valve-seat is of solid brass and the valve of leather (or may be of rubber).

The seat is drawn down on the base by four brass nuts at the upper end of the rods extending from the base, pressing the stiffening ring down upon the distance pieces, securing it as if it were part of the base, leaving the stand-pipe entirely independent.

"Mellert" Hydrant.



Patented June 10, 1890.

PRICES.

No. 1,	with one $2\frac{1}{2}$ or 3 inch nozzle, . . .	$29 00
2,	" two $2\frac{1}{2}$ or 3 inch nozzles, . . .	31 00
3,	" steamer and hose connection combined, .	32 00
4,	" two hose and one steamer connections, .	39 00

Nos. 1, 2, and 3 are made for 4 or 6 inch pipe connection.

No. 4, for 6-inch pipe connection.

Discount *per cent.*

DIRECTIONS.

For Removing Valve and Brass Seat.

Take cap from top of stand-pipe by removing the half-inch bolts in flange; placing wrench on the main nut, screw the cap off, withdraw the drip-valve, shut off the water in main, take off the brass nuts at top of rods extending from the base, remove the stiffening ring and the four pieces of wrought-iron tubing, and pull the main valve and seat up through the casing.

In ordering, please say whether hydrant is wanted to open to right or left, and give size and style of top nut; number and size of nozzles, and whether male or female; send hose coupling or one of the nozzle caps.

Unless specific directions are given, we will furnish our standard hydrant.

Lamp Posts.

Price $6.50. Weight 260 lbs. per post.

Discount *per cent.*

Having made lamp posts almost from the time we started out in the foundry business, we are well prepared to furnish them of different styles, and upon short notice. The cut here represents a post of our last and neatest pattern, which we will furnish with either bar or collar, at the pleasure of the buyer.

Hitching Posts.

No. 1.

No. 2.

No. 3.

No. 4.

No. **1**.. .....Price	$2 50	No. **3**.....Price	$5 00
2..... "	3 50	**4**..... "	5 50

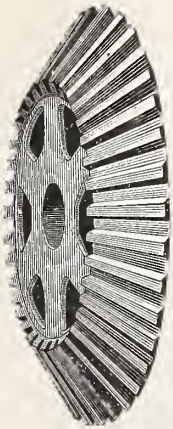
Discount *per cent.*

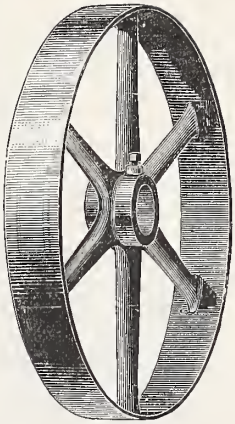
No. 3 of these posts we can change so as to have an eagle head or a pineapple instead of a horse head, according to the taste of the buyer. We have a number of other patterns. Those shown in the above cuts, however, we consider our neatest. We sell a great many of these posts, and think that no house or home, whether in the city or country, is complete without a respectable-looking hitching post.

Structural Work.

We have one of the largest assortments of patterns for this class of work of any shop or foundry in this section. We make a large variety of columns, girders, jambs, sills, lintels, plates, caps, brackets, house fronts, awnings, railings, &c., &c. In this connection we would call the attention of builders, and the public generally, to the great variety of uses open to cast-iron pipe, where iron columns and wooden posts, or brick and stone pillars, have been used heretofore, as in the construction of barns and sheds; for the support of girders in cellars of churches, houses, factories, &c.; for porches, roofs, smoke-flues, &c. We cut these pipe to any length required: they can be stood with bell ends on flat stones or cast-iron bottom plates, and held in place very nicely by a top plate fastened with lag screws or bolts. These pipe can be readily drilled for the purpose of hanging or attaching partitions or almost anything on or against them. There are few buildings erected in these days for any purpose in which pipe cannot be used to very good advantage. They are cheap, durable, handsome, and fire-proof.

Gearing.





Of gearing we are prepared to furnish spur, bevel, mitre, internal, segment, and worm; spur mortise, bevel mortise, and mitre mortise. Pulleys of all sizes—split and solid, shafting, eouplings and hangers, &c. Gearing for rolling-mills, furnaees, forges, grist-mills, saw-mills, &c., also for steam, power, and hand eranes, for steam or power shears, &e., &c.

The Canada Turbine Water Wheel.

Patented by Charles Barber, of Meaford, Canada.

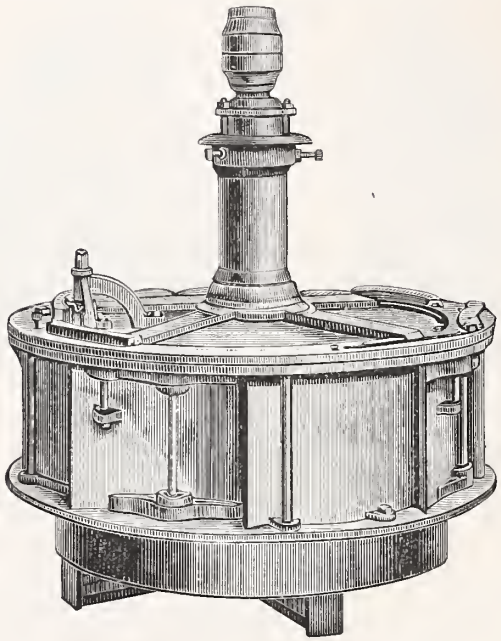


Fig. 1.

The Turbine Wheel affords the highest percentage of water power. There is difficulty, however, in selecting the best among the great variety of wheels in the market, where each is claimed to be the "best in the world," "the best in the market," "preferable to all others," "the best in existence," "none to equal it," &c., &c., advertised extensively in fancy and costly catalogues. We are not disposed to say anything against the numerous wheels offered to the public; but admit that there are many good wheels, and that most of them have reached the highest percentage of power obtainable by any wheel now invented or likely to be invented. However,

every wheel has its advantages and disadvantages, and we claim that the "Canada" has less disadvantages than others, while furnishing the same percentage of power. All we ask is that our wheel be properly placed, and given a fair trial. And where the wheel fails to do what we promise, we will remove it and pay all costs incurred in placing it, upon notice after trial.

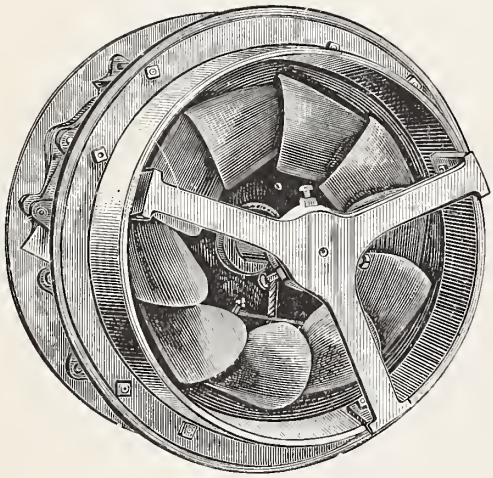


Fig. 2.

Size of Wheel.	Price.	Weight.
12-inch wheel	$135 00	269 lbs.
16 " "	145 00	435 "
20 " "	165 00	720 "
24 " "	190 00	1,015 "
30 " "	230 00	1,588 "
36 " "	295 00	2,138 "
42 " "	345 00	3,040 "
50 " "	425 00	4,050 "
60 " "	620 00	6,500 "

Discount *per cent.*

Table showing the Power, Revolutions per Minute, and Cubic Forty Feet, of the Canada Turbine Water Wheel, Manu-

Head in Feet.

		2	3	4	5	6	7	8	9
12-inch Wheel	Horse-Power.	.22	.39	.61	1.02	1.35	1.69	2.08	2.47
using 17 inches	Revolutions.	153	188	217	241	265	286	306	324
of water.	Cubic Feet.	69	84	97	129	142	152	162	173
16-inch Wheel	Horse-Power.	.46	.84	1.36	1.88	2.48	3.12	3.82	4.53
using 31 inches	Revolutions.	114	140	162	180	198	215	229	243
of water.	Cubic Feet.	147	179	215	238	261	282	302	318
20-inch Wheel	Horse-Power.	.69	1.50	2.05	2.86	3.75	4.71	5.79	6.72
using 47 inches	Revolutions.	91	112	130	144	158	171	183	194
of water.	Cubic Feet.	222	272	324	342	396	414	458	470
24-inch Wheel	Horse-Power.	1.30	1.92	3.09	4.29	5.54	7.08	8.69	10.14
using 71 inches	Revolutions.	73	90	108	121	132	144	153	162
of water.	Cubic Feet.	335	410	489	543	587	641	688	713
30-inch Wheel	Horse-Power.	1.68	2.94	4.62	6.42	8.46	10.75	13.16	15.45
using 108 inches	Revolutions.	61	73	86	96	105	114	122	130
of water.	Cubic Feet.	511	624	731	813	893	971	1042	1087
36-inch Wheel	Horse-Power.	2.35	4.33	6.82	9.34	12.41	15.58	18.99	22.65
using 159 inches	Revolutions.	51	62	72	80	88	95	102	108
of water.	Cubic Feet.	752	919	1080	1182	1310	1410	1503	1596
42-inch Wheel	Horse-Power.	3.24	5 94	9.25	12.84	16.92	21.25	26.06	30.90
using 218 inches	Revolutions.	44	54	62	67	76	82	87	92
of water.	Cubic Feet.	1031	1260	1477	1626	1786	1923	2063	21.87
50-inch Wheel	Horse-Power.	4.51	8.13	12.90	17.51	23.68	29.77	36.49	43 26
using 304 inches	Revolutions.	38	46	52	58	63	68	73	77
of water.	Cubic Feet.	1438	1758	2043	2218	2500	2694	2901	3045
60-inch Wheel	Horse-Power.	7.40	13.57	21.65	30.03	39.50	49.60	59.60	70.78
using 494 inches	Revolutions.	30	37	43	49	53	57	61	65
of water.	Cubic Feet.	2336	2855	3429	3805	4171	4368	4748	4947

		22	23	24	25	26	27	28	29
12-inch Wheel	Horse-Power.	9.49	10.12	10.79	11.51	12.32	12.89	13.57	14.22
using 17 inches	Revolutions.	507	518	530	541	551	562	573	583
of water.	Cubic Feet.	273	278	284	291	300	302	306	810
16-inch Wheel	Horse-Power.	17.39	18.56	19.77	21.12	22.41	23.76	25.36	26.71
using 31 inches	Revolutions.	380	388	397	405	413	422	431	437
of water.	Cubic Feet.	500	510	521	536	544	557	573	583
20-inch Wheel	Horse Power.	26.36	27.96	29.96	32.00	33.94	35.80	37.75	39.45
using 47 inches	Revolutions.	304	311	317	324	331	337	343	349
of water.	Cubic Feet.	759	768	790	810	826	839	853	861
24-inch Wheel	Horse-Power.	39.54	42.17	44.94	47.98	50.92	53.70	56.30	59.24
using 71 inches	Revolutions.	253	259	265	270	276	281	287	292
of water.	Cubic Feet.	1126	1161	1186	1215	1240	1259	1273	1291
30-inch Wheel	Horse-Power.	59.31	63.27	67.40	71.86	76.28	80.56	85.07	88.85
using 108 inches	Revolutions.	203	207	212	216	221	225	229	233
of water.	Cubic Feet.	1708	1742	1779	1821	1858	1889	1924	1940

Feet of Water used per Minute, under Heads of from Two to
factured by Mellert Foundry and Machine Co., Limited.

Head in Feet.

10	11	12	13	14	15	16	17	18	19	20	21
2.89	3.29	3.84	4.31	4.82	5 35	5.88	6.44	7.03	7.67	8.24	8.78
342	360	374	392	405	419	432	446	460	473	484	495
183	195	202	210	218	225	232	239	247	259	261	264
5.33	6.21	7.05	7.93	8.82	9.80	10.60	11.81	12.89	14.06	14 97	16.10
256	270	280	293	303	314	324	335	345	354	363	371
337	357	372	386	399	413	419	438	453	468	474	485
8.07	9.42	10.69	12.01	13.37	14.85	16.32	17.90	19.55	21.30	22.28	24.41
205	216	225	234	243	251	259	267	275	283	289	297
511	542	564	585	605	626	646	665	688	709	724	736
12.11	14.05	16.04	18.04	20.07	22.28	24.10	26.85	29.31	31.69	34.34	36.62
171	180	188	196	203	209	216	223	230	236	243	248
767	809	849	879	911	941	954	998	1031	1056	1087	1104
18.16	21.20	24.06	27.02	30.10	33.43	36.14	40.02	43.97	47.94	50.50	55.18
137	143	149	156	162	167	173	178	183	189	194	198
1150	1221	1270	1316	1360	1400	1431	1488	1547	1598	1631	1664
26.53	31.09	35.29	39.63	44.16	48.93	53.02	59.08	64.50	70.31	75.53	
114	117	125	130	135	140	144	149	153	157	161	
1689	1790	1863	1931	1998	2066	2099	2197	2270	2343	2392	
36.32	42.40	48.12	54.05	60.15	66.85	73.60	80.71	87.95	95.81	103.01	
98	103	107	112	117	120	123	127	131	135	138	
2301	2442	2540	2633	2721	2823	2914	3002	3095	3194	3263	
50.39	59.37	67.36	75.67	84.29	93.60	103.83	112.80	123.14	134.23	144.22	
81	86	90	94	97	101	104	107	110	113	116	
3192	3419	3556	3687	3814	3953	4111	4196	4333	4474	4568	
84.81	98.37	102.29	126.30	140.50	155.97	170.53	187.00	205.20	221.85	240.33	
68	71	75	78	81	84	87	90	92	95	97	
5373	5666	5928	6154	6357	6588	6752	6956	7222	7395	7613	

30	31	32	33	34	35	36	37	38	39	40
14.87	15.91	16.90	17.74	18.55	19.37	20.21	20.95	21.93	22.78	23.67
593	603	612	621	630	639	648	657	666	675	684
314	324	334	340	345	350	355	358	365	369	374
28.04	29.38	30.92	32.52	34.02	35.52	37.06	38.64	40.19	41.79	43.40
444	451	459	466	472	478	486	493	499	506	513
592	600	612	624	633	641	651	661	669	678	687
41.31	42.90	45.76	49.29	51.55	53.83	56.16	58.55	60.30	63.33	65.76
355	362	367	373	378	383	389	394	399	405	410
872	876	906	946	960	972	986	1002	1015	1028	1041
61.97										
297										
1307										
92.95										
238										
1963										

General Foundry and Machine Work.

We are prepared to do, and have done for a period of forty years, a great deal of general foundry and machine work not specified in this catalogue. We are well fixed to undertake almost anything in the way of general foundry and machine work, light or heavy, and shall always be pleased to furnish information and our best prices.

Water Works.

Twenty-five or thirty years ago the water works of a city or town were looked upon more as a luxury than a necessity. Their growth in this country and elsewhere within the last ten years has been marvelous, and no city or town of any importance can now afford to remain without water works. One of the first things a people will do upon throwing off the dead garments of their place, in which they had been buried, as it were, they will look about for a public water supply, of which there are three systems in vogue, viz.:

1st. Gravity.
2d. Pumping and Gravity.
3d. Direct. (Pumping directly into mains.)

The gravity system, where the conditions are favorable, is the most desirable, although either system is better than none. Pumping may be done by steam, water power, or electricity: the latter power will undoubtedly force its way in this direction as it already has in others.

Where people are about to build water works we would suggest to them the employment of a competent civil engineer as a matter of economy and business precaution.

We would also recommend to them William R. Billings' book on "Water Works Construction," and J. T. Fanning's "Treatise on Hydraulic and Water Supply Engineering."

Should the trade favor us, we shall do our best to supply it with pipe, fittings, stop valves, fire hydrants, street stop and service cock boxes, packing and lead: indeed, with everything necessary in the building of complete water works, whatever the system. What we do not make ourselves we can obtain.

We have had large experience in furnishing supplies for water works, and in building them, and shall be pleased to place it at the service of our patrons, to whom we are thankful for past favors and hope to merit a continuance of the same for the future.

Respectfully, &c.,

Mellert Foundry & Machine Company, Limited.

Reading, Pa., January 1, 1891.

Discharge of Water in Pipes.

To compute volume discharged when length of pipe, head or fall, and diameter are given.

RULE. Divide Tabular Number (see table below), opposite to diameter of pipe, by square root of rate of inclination, and quotient will give volume required in cubic feet per minute.

EXAMPLE. A pipe has a diameter of 36 inches, and a length of 2025 feet; what is the discharge per minute under a head of 9 feet?

Tab. No. for 36 ins.=36725 and $\frac{36725}{\sqrt{\frac{2025}{9}}}=\frac{36725}{15}=2448.3$ cubic feet.

(Tab. No. 36725. Divide length of pipe—2025—by head—9=225; find square root of 225=15, by which divide the tabular number, and quotient is answer.)

Tabular Numbers

For any length and head, and for diameters from 1 inch to 10 feet. In cubic feet per minute.

Diam.	Tab No.	Diam.	Tab. No.	Diam.	Tab. No.	Diam.	Tab. No.	Diam.	Tab. No.
ins.		ft. in		ft. in.		ft. in.		ft in.	
1	4.71	9	1147.6	1—11	11983	3— 1	39329	4—9	115854
1.25	8.48	10	1493.5	2	13328	3— 2	42040	5	131703
1.5	13.02	11	1894.9	2—1	14758	3— 3	44863	5—3	148791
1.75	19.15	1	2356	2—2	16278	3— 4	47794	5—6	167139
2	26.69	1—1	2876.7	2—3	17889	3— 5	50835	5—9	186786
2.5	46.67	1—2	3463.3	2—4	19592	3— 6	53995	6	207754
3	73.5	1—3	4115.9	2—5	21390	3— 7	57265	6—6	253781
3.5	108.14	1—4	4836.9	2—6	23282	3— 8	60648	7	305437
4	151.02	1—5	5628.5	2—7	25270	3— 9	64156	7—6	362935
4.5	194.84	1—6	6493.1	2—8	27358	3—10	67782	8	426481
5	263.87	1—7	7433	2—9	29547	3—11	71526	8—6	496275
6	416.54	1—8	8449	2—10	31834	4	75392	9	572508
7	612.32	1—9	9544	2—11	34228	4— 3	87730	9—6	655369
8	854.99	1—10	10722	3	36725	4— 6	101207	10	745038

This table is applicable to sewers and drains by taking same proportion of tabular numbers that area of cross-section of water in sewer or drain bears to whole area of sewer or drain.

Items of Information.

RESERVOIRS, CISTERNS, TANKS, &c. (round); to find capacity of:

Multiply the square of the mean diameter by the depth (all in feet), and this product by $5\frac{7}{8}$; the result will be in *gallons*—absolutely correct.

To find the contents in barrels: Take $\frac{3}{16}$ *of the product.* For greater accuracy, *diminish answer* $\frac{1}{2}$ *of 1 per cent. of itself.*

Find contents in barrels of a round cistern 20 feet diameter, 10 feet deep:

$20\times20\times10=4000$; $\frac{3}{16}$ of $4000=750$ barrels.

Find capacity in gallons of a stand-pipe 10 feet diameter and 100 feet high:

$10\times10\times100\times5\frac{7}{8}=58{,}750$ gallons.

To find the capacity of a square reservoir, cistern, or tank: Multiply the number of cubic feet by $7\frac{1}{2}$ *(7.48);* the result will be in gallons.

To find the contents in barrels: *Multiply the cubic feet by .2375.*

Barrels. To find the contents of a barrel or cask: Multiply the square of the mean diameter by the depth (all in inches) and multiply the product by .0034.

Find the contents of a barrel whose mean diameter is 20 inches, depth 32 inches:

$20\times20\times32\times.0034=43.52$ or $43\frac{1}{2}$ gallons.

To compute pressure of water per square inch:

Rule 1. Multiply the fall or head, in feet, by weight of a cubic foot of water (62.355 lbs.), and divide product by 144; quotient will give weight or pressure per square inch.

Note.—When fall is given in inches, omit division by 144.

Rule 2. Multiply the fall or head, in feet, by .433 (pressure per square inch for 1 foot, viz.: weight of one cubic foot of water 62.355 lbs., divided by 144 square inches equals .433).

Weight of one cubic foot of water..... 62.355 lbs.
Weight of one gallon of water..... 8.336 lbs.

One cubic foot of water contains 7.48 gallons.
One barrel of water contains 31.5 gallons.

Items of Information.—(*Continued.*)

To ascertain the weight of cast-iron pipe of given diameter and thickness of metal, refer to table "Areas of Circles," pages 32–34; find area of outside diameter, from which deduct area of inside diameter, and result will be cubic inches of iron for 1 inch length of pipe; multiply this by total length in inches of pipe and again by .263 (weight of 1 cubic inch).

EXAMPLE. What is weight of a 20-inch cast-iron pipe, 12 feet long, ¾-inch metal?

Area of 21½ inches (outside diameter), 363.051—area for 20 inches (inside diameter), 314.16=48.891×144 inches×.263 lb. *Ans.*, 1852 lbs.

For flange pipe the flanges must be calculated same way and added.

For bell and spigot pipe add weight of 1 foot of pipe as an equivalent for the bell.

Weight of Metals.

1	cubic	inch	of	zinc	weighs	.26 of a pound.
1	"	"	"	cast-iron	"	.263 "
1	"	"	"	wrought-iron	"	.281 "
1	"	"	"	steel	"	.283 "
1	"	"	"	brass	"	.3037 "
1	"	"	"	copper	"	.3225 "
1	"	"	"	lead	"	.4103 "

To Extract Square Root.

RULE. Point off given number into periods of two figures each, beginning with units. Ascertain greatest square in left-hand period, and place its root in quotient; subtract square number from this period, and to remainder bring down next period for a dividend.

Double this root for a trial divisor; find how often it is contained in dividend, exclusive of right-hand figure; write the quotient as the next figure of the root, and also place it on the right of the trial divisor, to form a complete divisor. Multiply the complete divisor by the root figure last found, subtract the product from the dividend, and bring down next period, and proceed as before.

NOTE. Mixed decimals must be pointed off both ways from units.

Three examples. What are square roots of 42025, 86, and 27.5?

$\dot{4}2\dot{0}2\dot{5}$ (205 *Ans.*	$\dot{8}\dot{6}$ (9.27 + *Ans.*	$\dot{2}\dot{7}.\dot{5}0$ (5.24 + *Ans.*
4	81	25
405) 2025	182) 500	102) 250
2025	364	204
	1847) 13600	1044) 4600
	12929	4176
	671	424

To Find Required Thickness of Metal for Cast-Iron Pipe.

To find required thiekness of metal for east-iron pipe under given head or fall of water, the following empirieal rule is given:

$$\left(\frac{\sqrt{D}}{10}+.15\right)+\left(\frac{H\times D}{25000}\right)$$

D—Diameter in inches.

H—Head or fall of water in feet.

EXAMPLE. What thickness of metal is required for a 30-ineh pipe under a head or fall of 300 feet?

First. Square root of diameter (30 inehes) is 5.4772 (see table below,) ÷ 10 + .15 = .69772.

Next. 300 × 30 ÷ 25000 = 0.36.

Add both results together and answer is 1.05772 inehes.

SQUARE ROOTS, 1 TO 60.

No.	Root.	No.	Root.	No.	Root.	No.	Root.
1	1	16	4	31	5.567764	46	6.78233
2	1.414214	17	4.123106	32	5.656854	47	6.855655
3	1.732051	18	4.242641	33	5.744563	48	6.928203
4	2	19	4.358599	34	5.830952	49	7
5	2.236068	20	4.472136	35	5.916080	50	7.071068
6	2.449490	21	4.582576	36	6	51	7.141428
7	2.645751	22	4.690416	37	6.082763	52	7 211103
8	2.828427	23	4.795832	38	6.164414	53	7.280110
9	3	24	4.898980	39	6.244998	54	7.348469
10	3.162278	25	5	40	6.324555	55	7.416199
11	3.316625	26	5.099020	41	6.403124	56	7.483315
12	3.464102	27	5.196152	42	6.480741	57	7.549834
13	3.605551	28	5.291503	43	6.557439	58	7.615773
14	3.741657	29	5.385165	44	6.633250	59	7.681146
15	3.872983	30	5.477226	45	6.708204	60	7.745967

Areas of Circles.

Diam.	Area.	Diam.	Area.	Diam.	Area.	Diam.	Area.
in.		in.		in.		in.	
3	7.0686	7	38.4846	14	153.938	21	346.361
1/16	7.3662	1/8	39.8713	1/8	156.7	1/8	350.497
1/8	7.6699	1/4	41.2826	1/4	159.485	1/4	354.657
3/16	7.9798	3/8	42.7184	3/8	162.296	3/8	358.842
1/4	8.2958	1/2	44.1787	1/2	165.13	1/2	363.051
5/16	8.618	5/8	45.6636	5/8	167.99	5/8	367.285
3/8	8.9462	3/4	47.1731	3/4	170.874	3/4	371.543
7/16	9.2807	7/8	48.7071	7/8	173.782	7/8	375.826
1/2	9.6211	8	50.2656	15	176.715	22	380.134
9/16	9.968	1/8	51.8487	1/8	179.673	1/8	384.466
5/8	10.3206	1/4	53.4563	1/4	182.655	1/4	388.822
11/16	10.679	3/8	55.0884	3/8	185.661	3/8	393.203
3/4	11.0447	1/2	56.7451	1/2	188.692	1/2	397.609
13/16	11.416	5/8	58.4264	5/8	191.748	5/8	402.038
7/8	11.7933	3/4	60.1322	3/4	194.828	3/4	406.494
15/16	12.177	7/8	61.8625	7/8	197.933	7/8	410.973
4	12.5664	9	63.6174	16	201.062	23	415.477
1/16	12.962	1/8	65.3968	1/8	204.216	1/8	420.004
1/8	13.3641	1/4	67.2008	1/4	207.395	1/4	424.558
3/16	13.772	3/8	69.0293	3/8	210.598	3/8	429.135
1/4	14.1863	1/2	70.8823	1/2	213.825	1/2	433.737
5/16	14.606	5/8	72.7599	5/8	217.077	5/8	438.364
3/8	15.033	3/4	74.6621	3/4	220.354	3/4	443.015
7/16	15.465	7/8	76.5888	7/8	223.655	7/8	447.69
1/2	15.9043	10	78.54	17	226.981	24	452.39
9/16	16.349	1/8	80.5158	1/8	230.331	1/8	457.115
5/8	16.8002	1/4	82.5161	1/4	233.706	1/4	461.864
11/16	17.257	3/8	84.5409	3/8	237.105	3/8	466.638
3/4	17.7206	1/2	86.5903	1/2	240.529	1/2	471.436
13/16	18.19	5/8	88.6643	5/8	243.977	5/8	476.259
7/8	18.6655	3/4	90.7628	3/4	247.45	3/4	481.107
15/16	19.147	7/8	92.8858	7/8	250.948	7/8	485.979
5	19.635	11	95.0334	18	254.47	25	490.875
1/16	20.129	1/8	97.2055	1/8	258.016	1/8	495.796
1/8	20.629	1/4	99.4022	1/4	261.587	1/4	500.742
3/16	21.135	3/8	101.6234	3/8	265.183	3/8	505.712
1/4	21.6476	1/2	103.8691	1/2	268.803	1/2	510.706
5/16	22.166	5/8	106.1394	5/8	272.448	5/8	515.726
3/8	22.6907	3/4	108.4343	3/4	276.117	3/4	520.769
7/16	23.221	7/8	110.7537	7/8	279.811	7/8	525.838
1/2	23.7583	12	113.098	19	283.529	26	530.93
9/16	24.301	1/8	115.466	1/8	287.272	1/8	536.048
5/8	24.8505	1/4	117.859	1/4	291.04	1/4	541.19
11/16	25.406	3/8	120.277	3/8	294.832	3/8	546.356
3/4	25.9673	1/2	122.719	1/2	298.648	1/2	551.547
13/16	26.535	5/8	125.185	5/8	302.489	5/8	556.763
7/8	27.1086	3/4	127.677	3/4	306.355	3/4	562.003
15/16	27.688	7/8	130.192	7/8	310.245	7/8	567.267
6	28.2744	13	132.733	20	314.16	27	572.557
1/8	29.4648	1/8	135.297	1/8	318.099	1/8	577.87
1/4	30.6797	1/4	137.887	1/4	322.063	1/4	583.209
3/8	31.9191	3/8	140.501	3/8	326.051	3/8	588.571
1/2	33.1831	1/2	143.139	1/2	330.064	1/2	593.959
5/8	34.4717	5/8	145.802	5/8	334.102	5/8	599.371
3/4	35.7848	3/4	148.49	3/4	338.164	3/4	604 807
7/8	37.1224	7/8	151.202	7/8	342.25	7/8	610.268

Areas of Circles.

Diam.	Area.	Diam.	Area.	Diam.	Area.	Diam.	Area.
in.		in.		in.		in.	
28	615.754	35	962.115	42	1385.45	49	1885.75
1/8	621.264	1/8	969.	1/8	1393.7	1/8	1895.38
1/4	626.798	1/4	975.909	1/4	1401.99	1/4	1905 04
3/8	632.357	3/8	982.842	3/8	1410.3	3/8	1914.72
1/2	637.941	1/2	989.8	1/2	1418.63	1/2	1924.43
5/8	643.549	5/8	996.783	5/8	1426.99	5/8	1934.16
3/4	649.182	3/4	1003.79	3/4	1435.37	3/4	1943.91
7/8	654.84	7/8	1010.822	7/8	1443.77	7/8	1953.69
29	660.521	36	1017.878	43	1452.2	50	1963.5
1/8	666.228	1/8	1024.96	1/8	1460.66	1/8	1973.33
1/4	671.959	1/4	1032.065	1/4	1469.14	1/4	1983.18
3/8	677.714	3/8	1039.195	3/8	1477.64	3/8	1993.06
1/2	683.494	1/2	1046.349	1/2	1486.17	1/2	2002.97
5/8	689.299	5/8	1053.528	5/8	1494.73	5/8	2012.89
3/4	695.128	3/4	1060.732	3/4	1503.3	3/4	2022.85
7/8	700.982	7/8	1067.96	7/8	1511.91	7/8	2032.82
30	706.86	37	1075.213	44	1520.53	51	2042.83
1/8	712.763	1/8	1082.49	1/8	1529.19	1/8	2052.85
1/4	718.69	1/4	1089.792	1/4	1537.86	1/4	2062.9
3/8	724.642	3/8	1097.118	3/8	1546.56	3/8	2072.98
1/2	730.618	1/2	1104.469	1/2	1555.29	1/2	2083.08
5/8	736.619	5/8	1111.844	5/8	1564.04	5/8	2093.2
3/4	742.645	3/4	1119.244	3/4	1572.81	3/4	2103.35
7/8	748.695	7/8	1126.669	7/8	1581.61	7/8	2113.52
31	754.769	38	1134.118	45	1590.43	52	2123.72
1/8	760.869	1/8	1141 591	1/8	1599.28	1/8	2133.94
1/4	766.992	1/4	1149.089	1/4	1608.16	1/4	2144.19
3/8	773.14	3/8	1156.612	3/8	1617.05	3/8	2154.46
1/2	779.313	1/2	1164.159	1/2	1625.97	1/2	2164.76
5/8	785.51	5/8	1171.731	5/8	1634.92	5/8	2175.08
3/4	791.732	3/4	1179.327	3/4	1643.89	3/4	2185.42
7/8	797.979	7/8	1186.948	7/8	1652.89	7/8	2195.79
32	804.25	39	1194.593	46	1661.91	53	2206.19
1/8	810.545	1/8	1202.263	1/8	1670.95	1/8	2216.61
1/4	816.865	1/4	1209.958	1/4	1680.02	1/4	2227.05
3/8	823.21	3/8	1217.677	3/8	1689.11	3/8	2237.52
1/2	829.579	1/2	1225.42	1/2	1698.23	1/2	2248.01
5/8	835.972	5/8	1233.188	5/8	1707.37	5/8	2258.53
3/4	842.391	3/4	1240.981	3/4	1716.54	3/4	2269.07
7/8	848.833	7/8	1248.798	7/8	1725.73	7/8	2279.64
33	855.301	40	1256.64	47	1734.95	54	2290.23
1/8	861.792	1/8	1264.506	1/8	1744.19	1/8	2300.84
1/4	868.309	1/4	1272.397	1/4	1753.45	1/4	2311.48
3/8	874 85	3/8	1280.312	3/8	1762.74	3/8	2322.15
1/2	881.415	1/2	1288.252	1/2	1772.06	1/2	2332.83
5/8	888.005	5/8	1296.217	5/8	1781.4	5/8	2343.55
3/4	894.62	3/4	1304.206	3/4	1790.76	3/4	2354.29
7/8	901.259	7/8	1312.219	7/8	1800.15	7/8	2365.05
34	907.922	41	1320.257	48	1809.56	55	2375.83
1/8	914.611	1/8	1328.32	1/8	1819.	1/8	2386.65
1/4	921.323	1/4	1336.407	1/4	1828.46	1/4	2397.48
3/8	928.061	3/8	1344.519	3/8	1837.95	3/8	2408.34
1/2	934.822	1/2	1352.655	1/2	1847.46	1/2	2419.23
5/8	941.609	5/8	1360.816	5/8	1856.99	5/8	2430.14
3/4	948.42	3/4	1369.001	3/4	1866.55	3/4	2441.07
7/8	955.255	7/8	1377.211	7/8	1876.14	7/8	2452.03

Areas of Circles.

Diam.	Area.	Diam.	Area.	Diam.	Area.	Diam.	Area.
in.		in.		in.		in.	
56	2463.01	63	3117.25	70	3848.46	77	4656.64
1/8	2474.02	1/8	3129.64	1/8	3862.22	1/8	4671.77
1/4	2485.05	1/4	3142.04	1/4	3876.	1/4	4686.92
3/8	2496.11	3/8	3154.47	3/8	3889.8	3/8	4702.1
1/2	2507.19	1/2	3166.93	1/2	3903.63	1/2	4717.31
5/8	2518.3	5/8	3179.41	5/8	3917.49	5/8	4732.54
3/4	2529.43	3/4	3191.91	3/4	3931.37	3/4	4747.79
7/8	2540 58	7/8	3204.44	7/8	3945.27	7/8	4763.07
57	2551.76	64	3217.	71	3959.2	78	4778.37
1/8	2562.97	1/8	3229.58	1/8	3973.15	1/8	4793.7
1/4	2574.2	1/4	3242.18	1/4	3987.13	1/4	4809.05
3/8	2585.45	3/8	3254.81	3/8	4001.13	3/8	4824 43
1/2	2596.73	1/2	3267.46	1/2	4015.16	1/2	4839.83
5/8	2608.03	5/8	3280.14	5/8	4029.21	5/8	4855.26
3/4	2619.36	3/4	3292.84	3/4	4043.29	3/4	4870.71
7/8	2630.71	7/8	3305.56	7/8	4057.39	7/8	4886.18
58	2642.09	65	3318.31	72	4071.51	79	4901.68
1/8	2653.49	1/8	3331.09	1/8	4085.66	1/8	4917.21
1/4	2664.91	1/4	3343.89	1/4	4099.84	1/4	4932.75
3/8	2676.36	3/8	3356.71	3/8	4114.04	3/8	4948.33
1/2	2687.84	1/2	3369.56	1/2	4128.26	1/2	4963.92
5/8	2699.33	5/8	3382.44	5/8	4142.51	5/8	4979.55
3/4	2710.86	3/4	3395.33	3/4	4156.78	3/4	4995.19
7/8	2722.41	7/8	3408.26	7/8	4171.08	7/8	5010 86
59	2733 98	66	3421.2	73	4185.4	80	5026.56
1/8	2745.57	1/8	3434.17	1/8	4199.74	1/8	5042 28
1/4	2757.02	1/4	3447.17	1/4	4214.11	1/4	5058.03
3/8	2768.84	3/8	3460.19	3/8	4228.51	3/8	5073.79
1/2	2780.51	1/2	3473 24	1/2	4242.93	1/2	5089.59
5/8	2792.21	5/8	3486.3	5/8	4257.37	5/8	5105.41
3/4	2803.93	3/4	3499.4	3/4	4271.84	3/4	5121 25
7/8	2815.67	7/8	3512.52	7/8	4286.33	7/8	5137.12
60	2827.44	67	3525.66	74	4300.85	81	5153.01
1/8	2839.23	1/8	3538.83	1/8	4315.39	1/8	5168.93
1/4	2851.05	1/4	3552.02	1/4	4329.96	1/4	5184.87
3/8	2862.89	3/8	3565.24	3/8	4344.55	3/8	5200.83
1/2	2874.76	1/2	3578.48	1/2	4359.17	1/2	5216 82
5/8	2886.65	5/8	3591.74	5/8	4373.81	5/8	5232 84
3/4	2898.57	3/4	3605.04	3/4	4388.47	3/4	5248.88
7/8	2910.51	7/8	3618.35	7/8	4403.16	7/8	5264.94
61	2922.47	68	3631.69	75	4417.87	82	5281.03
1/8	2934.46	1/8	3645.05	1/8	4432.61	1/8	5297.14
1/4	2946.48	1/4	3658.44	1/4	4447.38	1/4	5313.28
3/8	2958.52	3/8	3671.86	3/8	4462.16	3/8	5329 44
1/2	2970.58	1/2	3685.29	1/2	4476.98	1/2	5345.63
5/8	2982.67	5/8	3698.76	5/8	4491.81	5/8	5361.84
3/4	2994.78	3/4	3712.24	3/4	4506.67	3/4	5378 08
7/8	3006.92	7/8	3725.75	7/8	4521.56	7/8	5394 34
62	3019.08	69	3739 29	76	4536.47	83	5410.62
1/8	3031.26	1/8	3752.85	1/8	4551.41	1/8	5426.93
1/4	3043 47	1/4	3766.43	1/4	4566.36	1/4	5443.26
3/8	3055.71	3/8	3780.04	3/8	4581.35	3/8	5459.62
1/2	3067.97	1/2	3793.68	1/2	4596.36	1/2	5476.01
5/8	3080.25	5/8	3807.34	5/8	4611 39	5/8	5492.41
3/4	3092.56	3/4	3821.02	3/4	4626.45	3/4	5508 84
7/8	3104.89	7/8	3834.73	7/8	4641.53	7/8	5525.3